THE DIAGNOSIS AND TREATMENT OF FRACTURE OF THE CARPAL SCAPHOID AND DISLOCATION OF THE SEMILUNAR BONE.

WITH A REPORT OF THIRTY CASES.

(Continued from page 362.)

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PART II.

DISLOCATION OF THE SEMILUNAR BONE WITH OR WITHOUT FRACTURE OF THE CARPAL SCAPHOID.

In reviewing the cases of dislocation of the bones of the wrist which are reported in the literature, we have found that there is a great confusion in the nomenclature of the subject, some authors speaking of posterior dislocation of the os magnum, while others describe the same lesion as "anterior dislocation of the semilunar." Still others have made the confusion greater by speaking of posterior dislocation of the semilunar, the occurrence of which we have good reason to doubt. We have preferred to include all the dislocations we have seen under the one heading, "Anterior Dislocation of the Semilunar," even though some of our cases, *e.g.*, Case 8, might strictly be called a posterior dislocation of the os magnum, for the X-ray shows that the convex surface of the semilunar is still in contact with the radius. As a matter of fact, when this patient was under ether, the semilunar was found almost free, and after the first operation an

X-ray showed that it had become entirely dislocated forward, so that it had to be reduced later.

We believe that "dislocation of the carpus" nearly always means "anterior dislocation of the semilunar." The latter lesion may or may not be complicated by a coincident anterior dislocation of the proximal fragment of the scaphoid. We are unable to explain why the cuneiform does not dislocate with the rest of the proximal row in these cases; but, as a matter of fact, it does not, except in injuries of very great violence, which are usually compound and accompanied by great laceration of the soft parts. It is probable that the ligaments which keep the cuneiform in relation with the semilunar are much more easily torn than the more resilient structures which lie on its ulna side.

The series of twelve cases whose reports are herewith presented offers a particularly instructive study of the clinical history and treatment of this lesion. Among these cases are found an example of each of the following variations:

1. Recent unreduced dislocation of the semilunar without fracture of the scaphoid.
2. Recent dislocation of the semilunar with fracture of the scaphoid (compound).
3. Old unreduced dislocation of the semilunar without fracture of the scaphoid.
4. Old unreduced dislocation of the semilunar with fracture of the scaphoid.

From these cases we are able to describe the clinical symptoms and examination soon after the injury, and also the ultimate result in both the cases in which the dislocation was reduced, and those in which the dislocation remained permanently unreduced.

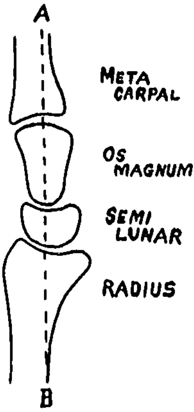
In our series, examples are also given which furnish data for comparison between the results of treatment by the following different methods:

1. Rest and massage without attempted reduction.
2. Immediate reduction after the injury.
3. Reduction several weeks after the injury.

4. Reduction by manipulation.
5. Reduction by open incision.
6. Reduction with excision of the proximal portion of the scaphoid.
7. Excision of the dislocated semilunar and proximal portion of the scaphoid.
8. Excision of the semilunar alone, years after the original injury, to relieve pressure on the median nerve.

EXPLANATION OF FIGURES.

A B—Normal axis of the bones forming the wrist-joint.
C D and *C′ D′*—Axis of semilunar.
F G and *F′ G′*—Axis of the os magnum and metacarpal.



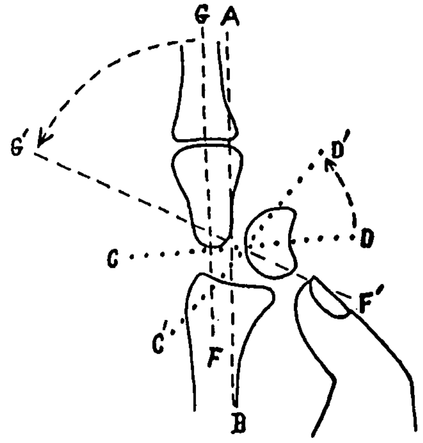


Fig. 1.—Normal relation of the wrist-bones. Lateral view.

Fig. 2.—Anterior dislocation of the semilunar. Lateral view. The semilunar lies in a position of extreme hyperflexion, its axis, *C D*, at right angles to *A B*. The axis, *F G*, of the os magnum and metacarpal (which act as one piece) is displaced posteriorly. To bring about reduction, hyperextension is made in the direction indicated by the arrows until the axis, *C D*, of the semilunar lies again parallel with the main axis, *A B*, of the joint, as seen in Fig. 3.

In order to thoroughly understand the mechanics of dislocation of the semilunar, it is necessary to speak briefly of the normal motion of the wrist-joint. This subject was studied by one of us (E. A. C.), and the results published in the

Journal of Experimental Medicine. It was shown that the distal row of carpal bones is so firmly bound together in one block by the interosseous ligaments that there is practically no motion between its individual components. The proximal or intermediate row is, however, quite movable, and the motions of flexion and extension of the wrist take place entirely in the two joints above and below the intermediate row. That is, in order to accomplish the full arc of 180 degrees from complete extension to complete flexion, each of these joints is movable through an arc of 90 degrees. For instance, if the wrist in complete flexion be looked at from the side, the axis of the semilunar bone would point at an angle of about 45 degrees to the vertical axis of the radius, while the long axis of the os magnum, which is continuous with that of the middle

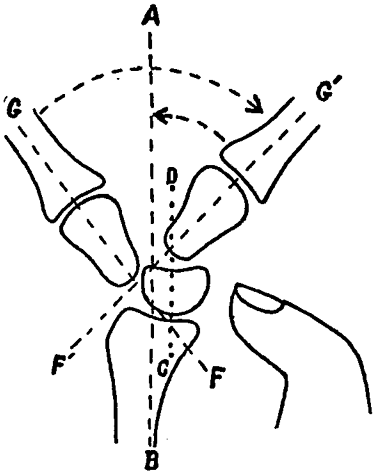


Fig. 3.—Pressure is now made by the surgeon's thumbs against the semilunar to retain it in contact with the articular surface of the radius, while flexion of the axis, *F G*, is made towards *F' G'*, as indicated by the upper arrow. With the re-establishment of the normal points of articular contact, a slight extension, as indicated by the lower arrow, will bring the axis of all the bones into the line *A B*. Practically, hyperextension and hyperflexion must be done with considerable force and carried through arcs of many more degrees than those represented in our diagrams. We have found that there is less tendency to redisplacement if the wrist is retained in plaster in a position of slight flexion, pressure with the thumbs in the flexure of the wrist being maintained while the plaster dries.

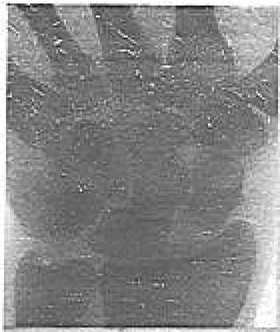
metacarpal, would stand at an angle of 45 degrees with the axis of the semilunar; thus the axis of the os magnum would stand at right angles with the vertical axis of the radius. The same would be true in complete extension. Now, if the hand in complete extension is still further forced backward, there comes a point at which the pressure ruptures the ligaments which are attached to the posterior horn of the semilunar, so that the latter bone is squeezed forward and the articular surface of the os magnum slides behind the semilunar and approaches the articular surface of the radius. In the mean time the semilunar, being still partially held to the radius by the ligament attached to its anterior horn, rotates so that its concave surface becomes directed forward. In this position it is obviously impossible for the normal arc of motion to be again secured, for at least 90 degrees of motion, which was the function of the semilunar, is lost, and the os magnum in its new bed can scarcely take up more than 50 or 60 degrees at the most.

Thus, since dislocation forward of the semilunar takes place by hyperextension, its reduction must take place by hyperflexion. Hyperextension is first made to drag the convex surface of the semilunar back into contact with the radial articular surface, and then, while the semilunar is prevented from rolling forward by pressure of the two thumbs of the surgeon at the anterior lip of the radius, hyperflexion is made over the surgeon's thumbs by an assistant. This allows the articular surface of the os magnum to again roll over the posterior horn of the semilunar bone to its proper facet.

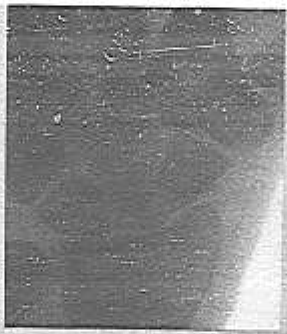
SYMPTOMS OF DISLOCATION OF THE SEMILUNAR BONE.

As in the cases of fracture of the scaphoid, the patient is usually a male of between thirty and forty years of age. He has suffered a severe injury to the wrist-joint of more violent character than that usually causing fracture of the scaphoid alone, probably due to a violent twisting or wrenching motion as well as direct hyperextension. There has been immediate and excessive pain, tenderness, and ecchymosis, and the attending physician has usually made a diagnosis of Colles fracture or severe sprain of the wrist. Perhaps an attempt at reduction of the supposed fracture has been made under ether, and splints have been used to relieve the intense pain. The diagnosis of dislocation has probably not been thought of until made by the X-ray. When seen some weeks after the injury, the patient is found to have little, if any, use of his hand. The wrist is perfectly stiff and the fingers held in half flexion, being incapable of either complete extension or flexion, and intolerably painful if passive motion is attempted. From the lateral view, the deformity of the wrist-joint suggests the silver-fork deformity of Colles fracture. (See photograph of Case 5.) There is a dorsal prominence caused by the head of the os magnum, and just above this a depression or groove, caused by the hollow formerly occupied by the semilunar. On the palmar side, just anterior to the lower end of the radius, there is a decided tumor under the flexor tendons. Pressure on this causes pain both local and referred to the distribution of the median nerve in the fingers. When both wrists are looked at from the palmar side there is a striking and characteristic difference. The hand of the injured side appears to belong to a different person; it seems smaller, shorter, and, if the injury is an old one, there is a distinct atrophy of the muscles of the whole forearm on the injured side. It is seen at once that the incapacity is far greater than in cases of fracture of the scaphoid, and greater even than in most cases of Colles fracture. The inability to flex and extend the fingers is particularly striking, and the shortened appearance of the hand is almost diagnostic. The X-ray must be relied on to give an ultimate diagnosis in these cases, particularly in deciding the point as to whether, in addition to a dislocation of the semilunar, there is also a fragment of the scaphoid displaced. Should crepitus be obtained or a second tumor found under the flexor tendons, the presence of a coincident fracture of the scaphoid is probable.

Analysis of our series of twelve cases brings out the following facts.

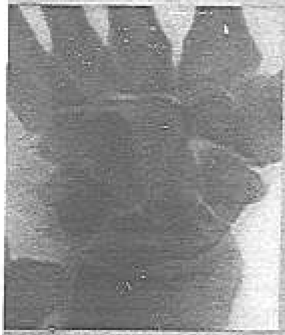


CASE. 16. (b)
JUNE 9. 1904.

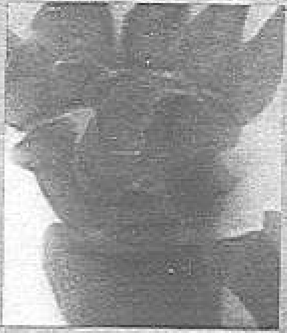


CASE. 17. (a).
APR. 28. 1904.

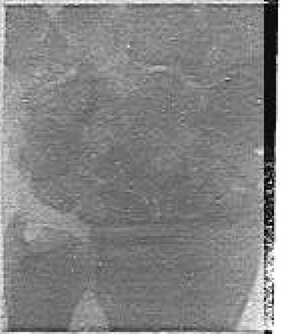
CASE. 17. (b)
OCT. 1904.



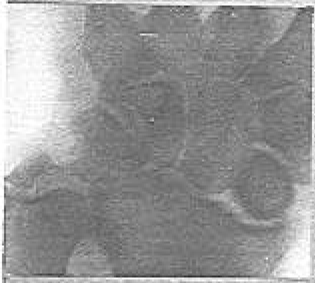
CASE. 18.
APR. 15. 1904.



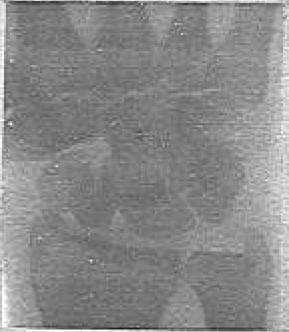
CASE. 18
NORMAL.



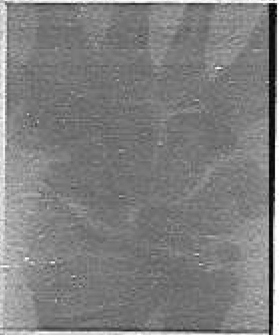
CASE. A.
1896.



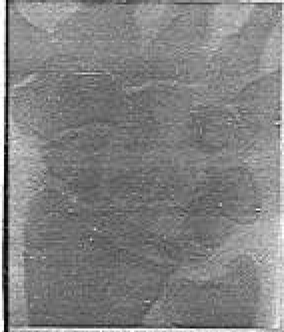
CASE. B.
JUNE 1, 1897.



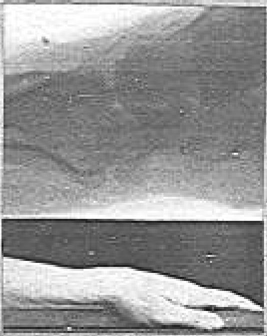
CASE. C.
DEC. 4. 1897.



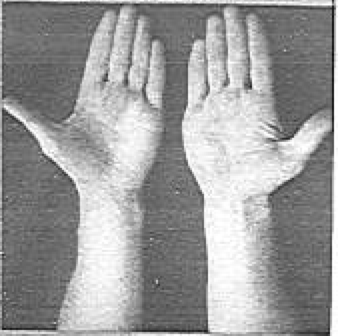
CASE. D.
JAN. 31. 1898.



CASE. E.
APR. 28. 1904.



CASE. E.
1904.



CASE. E.
DEC. 12. 1904.

The ages of ten of these patients were as follows:

1 case, 17 years.
1 case, 23 years.
2 cases, 27 years.
1 case, 29 years.
1 case, 30 years.
1 case, 31 years.
1 case, 35 years.
1 case, 36 years.
1 case, 47 years.

They were in all cases males.

It is probable that the reason for the prevalence of this injury in males between the ages of twenty and fifty is that individuals of these ages are more apt to be engaged in amusements or occupations which may lead to injuries of this character; that is, they are more apt to be thrown from bicycles, horses, or wagons; to have falls from staging or other more or less dangerous places where they are working. It is probable that the reason the lesion is less common below the age of twenty is that at this period of growth the injury causing such fractures is more apt to lead to fracture of one of the long bones in the region of the epiphysis. As a rule, the injuries which cause dislocation of the semilunar are of much more severe grade than those leading simply to fracture of the scaphoid, and hence are more apt to occur from a really severe accident than from the accidents ordinarily met with in athletics. For instance, the injuries which occurred in the cases which we report were as follows:

Fall from a high bicycle; fall of twenty feet; thrown from a runaway wagon; horse stepped on right wrist; wrist struck by a tub of coal; fall from second-story window; stepped into manure hole; fall down stairs; fall of twenty-five feet; fall from staging with ladder, with twisting of wrist; fall from polo pony with reins twisted about hand.

In eight cases the right wrist was injured; in four cases the left. In two cases the injury was due to direct violence, Cases D and E. In most of the cases the fall was so severe as to make the patient unable to recollect as to whether his hand was in extension or flexion. In only five cases can the history of this be obtained, and in these cases it occurred in extension. Personally, we have not seen a single case immediately after injury, but all cases reported that the pain, swelling, and tenderness were very great soon after the accident.

In most cases which did not have skiagraphs taken at once, the diagnosis was supposed to be "sprain" or an indefinite "fracture of the wrist." In only nine cases have we a record of the occupations of these individuals. The ones which are recorded are as follows:

Student, mechanic, teamster, coal-heaver, hack-driver, laborer in woollen mill, plumber, plasterer, and electrical engineer. In all these the injury occurred while the patient was working at his occupation, with the exception of two which occurred in athletic amusements. All of these cases have so much of individual variation, both in the types of the injuries and the methods in which they were treated, that each must be considered more or less by itself.

TREATMENT.

This series is particularly valuable for comparison in the methods of treatment employed, so that it is more instructive to study the cases from this point of view than from any other. As in simple fracture of the scaphoid, our treatment will vary according to the time at which we see the patient after the injury. If the case comes under observation immediately after the injury, and the dislocation of the semilunar is not accompanied by fracture of the scaphoid, it is obvious that simple reduction is the best method of treatment. That this may be readily accomplished with a good result is shown by the case of J. A. A. (Case 6). If, however, fracture of the scaphoid exists at the same time, and possibly the proximal fragment is also dislocated, it may be well to either excise the proximal fragment of the scaphoid and reduce the semilunar as in case of J. B. R. (Case 8), or to excise both the proximal portion of the scaphoid and the semilunar as in the case of A. C. (Case 11). It is evident that either of these methods is preferable to making no attempt at reduction, as in the cases of J. C., Jr. (Case 5), and E. S. (Case 1). We have unfortunately no instance to show whether a case with the semilunar dislocated and the scaphoid fractured can be reduced and the wrist brought into the same condition as in simple scaphoid fracture.

In such a case would it be better to continue fixation and endeavor to obtain union in the scaphoid, or to at once excise the fragment of the scaphoid and possibly the semilunar, which, of course, has no posterior ligamentous attachment. Certainly, the result in the case of A. C. is far better than any other case of dislocation of the semilunar which we have reported, except those in which the dislocation could be reduced and was not accompanied by fracture of the scaphoid.

If the case comes under observation weeks or months after the injury, we have another phase of the subject to consider. Since in the cases of P. F. (Case 9) and J. A. F. (Case 10) we were able to reduce the dislocation over a month after the injury and procure practically perfect results, we feel that attempt at such reduction should certainly be made until the surgeon is satisfied that he cannot accomplish it, even if he is obliged to cut down on the wrist-joint, as was done in the case of J. A. F. (Case 10). If, however, he is unable to reduce it after repeated attempts, we feel that it is better to excise the semilunar and the fragment of the scaphoid as in the case of A. C. (Case 11). We see no contraindication to doing this unless so much time has passed that the joint surfaces have become readjusted and the pain and stiffness have passed away, so that the patient is not greatly troubled by the deformity.

This brings us to a consideration of the third phase in which choice of treatment must be considered, that is, in cases in which the lesion has existed so long that the patient has arrived at the maximum benefit which rest and massage can give. This condition is exemplified in the cases of J. T. M., E. S., and J. C., Jr. (Cases 12, 1, and 5). In each of these cases several years have elapsed since the injury, and it is probable that the wrists of these patients in the future will not improve; in fact, after a certain point, experience seems to show that they tend to become worse rather than better. For instance, E. S. is troubled more now by pain from pressure on the median nerve than he has been previously, and in the case of J. T. M. the pain was so severe that it was considered wise to excise the semilunar bone. We could hardly hope, however, for such good results in these old cases as in such cases as that of A. C. (Case 11), because the joints in these cases have probably changed their shape to allow for the altered relations of the articular surfaces. It is probable, therefore, that even if the displaced fragments were excised, more or less chronic arthritis would still remain. However, it is our opinion that such patients, if they have decided pain as in Case 12, would be sufficiently benefited to compensate for the comparatively simple operation of removing the dislocated bones.

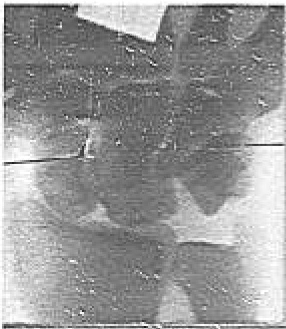
This operation can best be done through an anterior incision between the tendons at the flexure of the wrist, for by the posterior incision which we use in excision of the scaphoid, we should be unable to reach the anteriorly dislocated semilunar. Dr. Porter, in the case of J. T. M., used the anterior incision and found no difficulty in removing the semilunar. It is probable that a better result might have been obtained by also removing the proximal fragment of the scaphoid.

A comparison of the results of the case of J. B. R. (Case 8) and A. C. (Case 11) is very interesting. Both cases had the same lesions, *i.e.*, dislocation of the semilunar and fracture of the scaphoid with dislocation of the proximal fragment. In the case of J. B. R. the proximal fragment was excised and the semilunar was reduced. In the case of A. C. both were excised. The result in the latter case is distinctly better than in the former in respect to the amount of motion, though both men now have useful and practically painless joints. The comparison is not quite fair, however, because in J. B. R.'s case there was a compound dislocation of the entire carpus, and three operations were done in close sequence. This would make the chances of adhesion very much greater. Were such a case again to come into our hands, we should excise both the fragment and the semilunar.

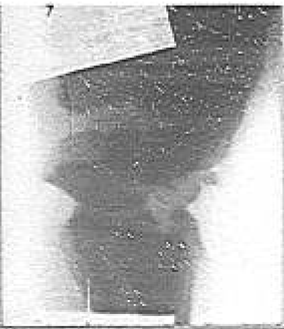
We feel quite certain that the following conclusions are justified:

I. In cases of dislocation of the semilunar without fracture of the scaphoid;

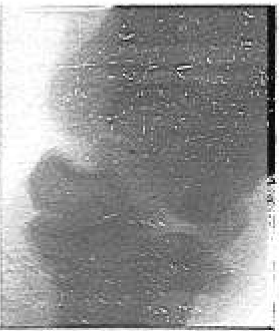
(*a*) It is best to attempt bloodless reduction, even if many weeks have elapsed since the injury.



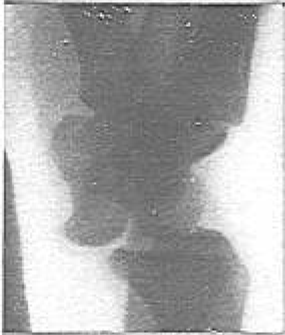
CASE. G.
JUNE 29. 1901.



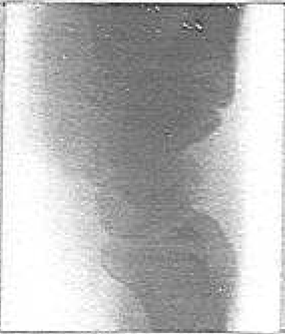
CASE. G.
JUNE 17. 1901.



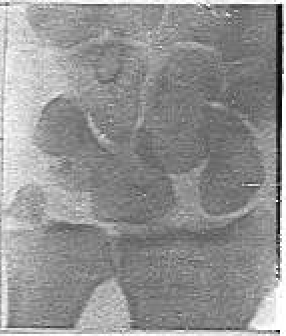
CASE. H.
AUG. 15. 1902.



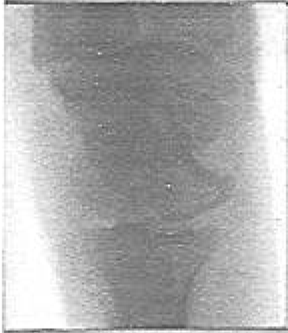
CASE. I.
FEB. 5. 1902. ULNA VIEW.



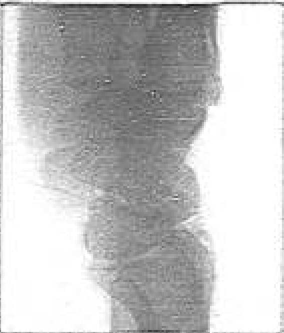
CASE. I.
FEB. 1904. RADIAL VIEW.



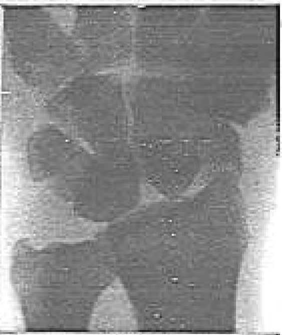
CASE. J.
MAY 21. 1903.



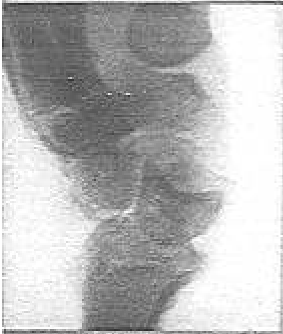
CASE. J.
MAY 21. 1903. ULNA VIEW.



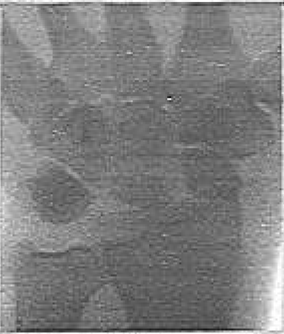
CASE. J.
JAN. 30. 1904. RADIAL VIEW.



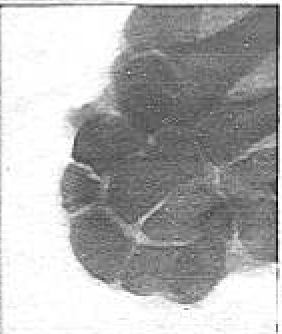
CASE. K.
DEC. 16. 1903.



CASE. K.
DEC. 11. 1903.



CASE. K.
APR. 16. 1904.



PROFESSOR DWIGHT'S
SPECIMEN.